

We claim:

1. A method for detection of an antibody against a pathogenic organism in a liquid sample, wherein said pathogenic organism is selected from the group consisting of bacteria, viruses and protozoa, the method comprising

a) incubating

(1) said sample,

(2) a solid phase,

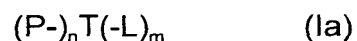
(3) a first antigen for said antibody, wherein the first antigen has at least one marker group, and

(4) a second antigen for said antibody, wherein the second antigen binds to the solid phase,

under conditions to obtain a complex comprising a solid phase-bound second antigen to which is bound the antibody and to which is bound the first antigen; and

b) detecting said antibody by direct or indirect detection of the marker group; and

wherein at least one of said antigen is of formula (Ia) or (Ib)



wherein

T is a carrier,

P is a peptide comprising an epitope region wherein said epitope region is reactive with the antibody,

L is the marker group or a group which binds to the solid phase,

- is a covalent coupling,  
n is 2-40 and  
m is 1-10.

2. The method of claim 1, wherein the first antigen comprises multiple epitope regions, said epitope regions being identical in amino acid sequence.

3. The method of claim 1, wherein the second antigen comprises multiple epitope regions, said epitope regions being identical in amino acid sequence.

4. The method of claim 1, wherein the first antigen and the second antigen comprise multiple epitope regions, said epitope regions being identical in amino acid sequence.

5. The method of claim 1, wherein the at least one marker group comprises a metal chelate marker group.

6. The method of claim 1, wherein said indirect detection of said antibody
- comprises:
    - c) providing in step b) the first antigen having the marker group comprising a hapten and a binding partner for the hapten being labeled with a signal generating group; and
    - d) detecting the antibody by detecting the signal-generating group.

7. The method of claim 6, wherein the hapten is selected from the group consisting of a sterol, a bile acid, a sexual hormone, a corticoid, a cardenolide, a cardenolide-glycoside, a bufadienol, a steroid-sapogenine and a steroid alkaloid, and wherein the specific binding partner comprises an antibody for the hapten.

8. The method of claim 1, wherein the second antigen is biotinylated and the solid phase is coated with streptavidin or avidin.

9. The method of claim 1, wherein the at least one of the first antigen and the second antigen comprises a carrier to which the epitope regions are covalently coupled, wherein the carrier is non-reactive with the antibody.

10. The method of claim 9, wherein the carrier is a natural or synthetic peptide or polypeptide or a synthetic polysaccharide.

11. The method of claim 10, wherein the carrier is selected from the group consisting of an albumin, an immunoglobulin, an immunoglobulin fragment, a  $\beta$ -galactosidase, a polylysine and a dextran.

12. The method of claim 1, wherein P is a synthetic peptide sequence of 6 to 50 amino acids.

13. The method of claim 12, wherein the synthetic peptide sequence is a

multimeric antigen comprising multiple, identical epitope regions and an immunologically inactive spacer region, said epitope regions being identical in amino acid sequence.

14. The method of claim 1, wherein P is a recombinant polypeptide sequence comprising a length of up to 1000 amino acids, wherein the polypeptide sequence comprises a single epitope region or a multiple of an epitope region.

15. The method of claim 1, wherein the first antigen and the second antigen is a recombinant fusion polypeptide wherein P is a mosaic peptide comprising multiple, immunologically reactive epitope regions optionally linked by immunologically inactive spacer regions.

16. A reagent for detection of an antibody against a pathogenic organism in a liquid sample, wherein said pathogenic organism is selected from the group consisting of bacteria, viruses and protozoa, the reagent comprising

- 1) a solid phase;
- 2) a first antigen for the antibody, wherein the first antigen has at least one marker group; and
- 3) a second antigen for the antibody, wherein the second antigen binds to the solid phase,

wherein at least one of said antigen is of formula (Ia) or (Ib)



wherein

T is a carrier,

P is a peptide comprising an epitope region, wherein said epitope region is reactive with the antibody,

L is the marker group or a group which binds to the solid phase,

- is a covalent coupling,

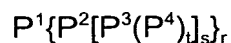
wherein n is 2-40 and

wherein m is 1-10.

17. The reagent of claim 16, wherein the at least one marker group comprises a hapten and the reagent further comprises a specific binding partner for the hapten, wherein the specific binding partner has a signal-generating group.

18. The reagent of claim 16, wherein the second antigen comprises multiple, identical epitope regions and is biotinylated, and wherein the solid phase is coated with streptavidin or avidin.

19. The method of claim 1, wherein P comprises at least one branching site of the formula



wherein

$P^1$  through  $P^4$  are each an amino acid sequence having a length of up to 50 amino acids wherein at least two of  $P^1$  through  $P^4$  comprise a copy of the single epitope and

$r$  is 1 or 2,

$s$  is an integer from 0 to 4 and

$t$  is an integer from 0 to 8,

with the proviso that  $r$ ,  $s$  and  $t$  are selected to result in  $P$  containing the at least one branching site and the several copies of the single epitope.

20. The method according to claim 19, wherein the at least one branching site is formed by a trifunctional amino acid.

21. The method of claim 1, wherein the several copies of the single epitope are directly covalently coupled to each other or are indirectly bound to each other via spacer regions which are covalently coupled between the copies.

22. The method according to claim 20, wherein the at least one branching site is formed by lysine, ornithine or both.

23. An antigen of the formula (1a) or (1b)



wherein

T is a carrier,

P is a peptide comprising an epitope region, wherein said epitope region is reactive with an antibody to be determined,

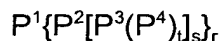
L is a marker group or a group which is bindable to a solid phase,

- is a covalent coupling,

n is 2-40 and

m is 1-10.

24. An antigen having at least one marker group or group which is bindable to a solid phase, several copies of a single epitope which is reactive with an antibody to be determined and at least one branching site, and is of the formula



wherein

P<sup>1</sup> through P<sup>4</sup> are each an amino acid sequence having a length of up to 50 amino acids wherein at least two of P<sup>1</sup> through P<sup>4</sup> comprise a copy of the single epitope and

r is 1 or 2, s is an integer from 0 to 4 and t is an integer from 0 to 8, with the proviso that r, s and t are selected to result in an antigen containing the at least one branching site and the several copies of the single epitope.